

would be an immense advantage. Prof. Macalister heads each page with the words, "Introduction to Animal Morphology." In so doing he seems to have entirely overlooked the fact that the object of the heading is to give some notion as to what is to be found below it, and not the title of the work itself. Why he has not followed the ordinary method of placing on the top of one of each two pages the subject of the chapter, and on the other further detail, we are at a loss to understand, and suffer accordingly in attempting to make any particular reference.

The first seven chapters of Prof. Macalister's work are on general subjects: protoplasm, general morphology, histology, tectology (individuality and the formation of organs), reproduction, and the distribution of animals. There are certain statements in the last of these with which we cannot quite agree. That Patagonia should be entirely removed from the Neotropical Region and placed together with the Southern Circumpolar Land in a special Antarctic, seems very much at variance with known facts. Why the Polar Bear should be only mentioned in association with the Nearctic Circumpolar Region; the Aard-vark, Manis, and Manatee with the Guinean; the Catarrhine Monkeys with the Indian; Bennett's Cassowary with the Australian; the Birds of Paradise with the Indo-Malay, we are at a loss to comprehend.

In association with the doctrine of the origin of species we are told that, "as a natural deduction from evolution, we have Dr. Haughton's law, that all structures are arranged so as to give the maximum of work possible under the given external conditions." This law is, however, a natural deduction from the theory of natural selection, not from evolution; it not being evolution, *per se*, but the struggle for existence which brings to the foreground the most economical animal machinery. It may also be mentioned that there are still wanting some important links in the chain of reasoning which explains the diminution of organs, like the wings of birds, in small islands. These seem to be lost on account of the reduction of the struggle for existence, mammals not being on the ground to contest the field. Dr. Haughton's law, therefore, no longer applies apparently. Why then are the wings lost?

The classification adopted is that of Haeckel modified, the Metazoa being primarily divided into the two sub-series, Polystomata (Sponges) and Monostomata; the Cœlenterata being removed from the Porifera, and included with the other forms in which there is but one aperture of ingress into the body-cavity. No very special stress is laid on the vertebrate affinities of the Tunicata, which are included in the sub-kingdom Vermes. Of their development we read that "in *Ascidia* and *Phallusia* the segmented yolk assumes its mulberry form, hollows within, and appears as a spherical, cellular body (blastula); a groove indents one side of this; the lips of the groove rise and close it in, except in one spot, and thus the body becomes bicavitory, the dorsal groove contracts, and the nerve ganglion develops either within it or in its close vicinity. On a plane between the dorsal neural cavity thus formed and the ventral space, a double row of large cells appears, which extends into the tail, and forms an axis for that organ. These cells resemble those of the *chorda dorsalis* of Vertebrates, and have a similar relation

to the neural and visceral cavities of the primarily bicavitory body to that possessed by the dorsal chord. Upon these phenomena, observed by Kowalewsky, Kupffer, and others, is rested the theory of relationship of Tunicates and Vertebrates, which is strengthened by the setting apart here of a portion of the digestive canal for respiratory purposes." This quotation illustrates the condensed manner in which the whole work is written and the way in which single words are frequently modified to do the duty of whole sentences. As a second illustration of the same method when employed with reference to the sub-kingdom Cœlenterata, one in which name-coining has arrived at a worse pitch even than in systematic botany—the following sentence will suffice:—"The alternation of generations may be binary (hydranth, gonophore, + hydranth, gonophore, &c.), or ternary (hydranth, blastostyle, gonophore, + *h*, *b*, *g*, &c.), or quaternary (hydranth, blastostyle, blastocheme, gonocheme, + *h*, *b*, *b*, *g*, &c.); or even more complex if the hydranths be heteromorphic." The Mollusca are treated of between the Vermes and Arthropoda, it being remarked of them that "their structure can be easily understood by regarding them as Vermes with no articulated appendages, modified by unequal lateral development, and by a fusion of the metameres," although "we know as yet of no absolute passage forms or direct synthetic types." This being the case, we cannot understand how each of these major groups can be regarded as a sub-kingdom.

The author, in his preface, regrets that, owing to the long time that the work (written in 1873) has been going through the press, he has not been able to introduce into it references to recent discoveries, which explains several important omissions. Notwithstanding this, we are convinced that all zoologists will agree that the work is a most valuable addition to the literature of general animal morphology.

#### OUR BOOK SHELF

*Introductory Text-book of Physical Geography.* By David Page. Eighth Edition. (Blackwood and Sons, 1876.)

INTRODUCTORY text-books on Physical Geography are not numerous, and if we may judge by the calls for new editions, this one is growing in favour. It certainly gives in a short and handy form the most important facts of the subject—and in the descriptive part it is merely a question of the selection of the most important, and in this respect we think the selection judicious, as indeed it would appear to have been found. Dr. Page comes to Physical Geography from the side of Geology, and his readers reap the benefit of it, in the chapters relating to the structure of the earth, and to the work of rivers, and to the positions of mountain ranges, which are very good. In many other respects too, the book is worthy of the support it receives, the facts being told clearly, concisely, and for the most part truly.

We cannot help, however, drawing attention to one or two points which we think would at least have been differently worded if the author had approached his subject from a physical side in his explanation of phenomena. Thus we are told with reference to water, that "when converted into steam it occupies 1,606 times more space with a specific gravity of only '622.'" The only standard of specific gravity mentioned is water at 62° F., and a physicist might ask at what *pressure* is the steam?

Again, we read, "the atmosphere being the medium

through which the sun's heat is conveyed to and from the earth, the lower and denser strata absorb the greatest amount, and are necessarily the warmer;" a sentence of which a teacher would score almost every word. Again, on the subject of dew, we read that "substances like glass, &c., which rapidly lose their own heat and slowly acquire that of others are susceptible of being copiously bedewed." The italics are ours. And once more, "when the temperature of the air is reduced below that of the invisible vapour it contains, the moisture becomes visible." These extracts could be multiplied till we might wonder if it is really a book on *Physical Geography* we are reading. But these are serious defects, and we wish they could be altered. By the side of them it is of less consequence that while we read in the Preface that "this revision embraces all that is important in recent discovery;" yet on turning to the temperature of the sea, where the most important changes have taken place in our knowledge, we are still referred to Sir James Clarke Ross, and told that the ocean has below the surface a uniform temperature of  $39\frac{1}{2}$ °, for which at the equator we must descend deeper than anywhere else. We can scarcely imagine that any amount of clearness will atone for these things; let us hope they will be seen to before edition the ninth is required.

*The Flora of South Australia.* By R. Schomburgk, Ph.D., Director of the Botanic Gardens, Adelaide. (W. C. Cox, 1875.)

We have here a complete list of the indigenous flora of South Australia, both tropical and extra-tropical, with some general remarks prefixed. The most predominant natural orders in the colony are Leguminosæ, Myrtaceæ, Compositæ, Proteaceæ, Cruciferae, Rubiaceæ, and Gramineæ. The genera and species are remarkably circumscribed in area; many are found in one spot alone. The colony is singularly devoid of native edible fruits and roots; on the other hand it produces abundance of valuable timber-trees and of plants suitable for the manufacture of paper and other fibres, and for the production of dyes; but most of the valuable crops are naturalised plants, introduced from Europe or other parts of the world.

A. W. B.

#### LETTERS TO THE EDITOR

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#### Theory of Electrical Induction

IN NATURE, vol. xiii. pp. 437, 475, Prof. Paul Volpicelli gives an exposition of the two theories of electric induction, containing copious references to the writings of electricians, and numerous experiments of his own. It is remarkable, however, that he has not only omitted all reference to the works of Poisson, Green, Thomson, Beer, Betti, &c., who have studied the mathematical theory of induction, but he has not even introduced the word potential into his exposition, unless we are to take the word tension in the sense of potential, where he says that a certain portion of electricity possesses tension while another portion does not.

The result of this mode of treating the subject without calling in the aid of those ideas and phrases which the progress of science has developed, is to convey the impression that the whole theory of induction of electrification on the surface of conductors is still in a very imperfect and vague condition, whereas there is no part of electrical science in which we can trace more distinctly the correspondence, quantitative as well as qualitative, of the phenomena with the general laws of electricity. It appears, however, from what M. Volpicelli says, that an erroneous theory is still generally adopted in treatises on physics and electricity, and that it ought to be superseded by a more correct theory first proposed by Melloni.

Both theories admit that if an insulated conductor, without

charge, is acted on by a charged inductor, the surface becomes electrified, oppositely to the charge of the inductor on the parts nearest the inductor, and similarly to the charge of the inductor on the parts farthest from it. The first of the two theories, however, asserts that both these electricities are "endowed with tension," whereas the second, that of Melloni, asserts that the electricity of the same kind with that of the inductor is alone "endowed with tension," while the other kind of electricity is entirely "latent or dissimulated."

The only sense which we can attach to the word "tension" as thus used, is that which modern writers mean by "potential" or potential function, the difference being that the word tension is often used in a vague manner, whereas potential is strictly defined.

Thus a point in space is said to have a certain electric potential, and since all points of a conductor in electrical equilibrium have the same potential, we speak of the potential of the conductor. But we do not speak of the potential of a charge of electricity, or of electricity being endowed or not endowed with potential. Such language would only lead us into error.

Let us suppose the inductor to be charged positively and the induced body to be insulated and originally without charge. Then, since its insulation prevents any electric communication with other bodies, its total electrification must remain zero, or there must be as much positive electrification as there is negative.

Hence for every line of electric force which proceeds from the inductor and falls on the induced body, there is another which proceeds from the induced body and falls on the walls of the room, or on some other body whose potential is zero. The potential of the induced body must therefore be intermediate between that of the inductor and that of the walls of the room, which is generally taken as zero. The potential of the induced body is therefore positive.

There is thus on the surface of the induced body a region nearer the inductor which is negatively electrified, and a region further from the inductor which is positively electrified. These regions are divided by a neutral line on the surface, which is the section of the surface by an equipotential surface in space which has the same potential as the induced body. The total charges on these two regions are exactly equal but of opposite signs.

If a small insulated conductor is placed in contact with any part of the surface and removed, it will be found to be electrified in the same way as the part of the surface with which it was in contact. A fine short needle point, or a burning pastille, placed on any part of the surface will dissipate the kind of electricity which exists on that part of the surface. See Riess, "Reibungs Elektricität," Art. 247.

If any part of the induced body is placed in electrical connection with the earth by touching it with a fine wire, positive electricity will be discharged, and the potential of the induced body will be reduced to zero. This will be the case whether the part touched be positively or negatively electrified. The quantity of electricity discharged will be the product of the potential of the induced body into its electric capacity.

After this discharge every part of the surface of the induced body will be negatively electrified, but the parts nearer the inductor more than those which are further from it.

In the mathematical treatment of the subject Thomson has found it convenient to divide the electrification into two parts, each distributed over the induced body according to its own law.

(a) The induced electrification when the induced body is connected to earth, and the charge of the inductor is  $E$ . This electrification is negative on every part of the surface, but the density is greatest next the inductor.

(b) The electrification when the induced body has a potential  $P$ , and the inductor, still in the same place, has no charge. This electrification is positive on every part of the surface.

From a knowledge of these two distributions it is easy to determine a third, in which the total electrification is the algebraical sum of (a) and (b), and in which the value of  $P$  is such that the total electrification is zero.

We might then assert that the electrification (b) is free, because it will be discharged if the body is connected to earth, but that the electrification (a) is latent or dissimulated, because it will not be discharged to earth.

The only danger of this mode of exposition is that it may suggest to a beginner the notion that electricity, like water and other substances, may exist in different physical states, in some of which it is more mobile than in others.

This idea of variation of quality once introduced into the